27. (New) A device according to claim 21, further comprising focal length detecting means for detecting the focal length of said variable magnification lens, wherein said control means controls said diaphragm according to the focal length detected by said focal length detecting means.

28. (New) A device according to claim 21, wherein said variable magnification lens is a zoom lens.--.

REMARKS

The present application is a continuation-in-part of parent application no. 09/263,078. In the parent application, Claims 1-17 were allowed and a Notice of Allowance issued on January 11, 2001. The present CIP application was filed to prosecute additional claims and to disclose the subject matter shown in Figures 21-25. The new claims not found in the parent application are Claims 1-11. Since Applicants wish to prosecute only a single application, Applicants intend to abandon the parent application in favor of this CIP. As a result, Applicants have added the claims from the parent application to this CIP as Claims 12-28. Applicants submit that Claims 12-28 should now be allowed because they are identical to allowed Claims 1-17 in the parent application.

Applicants are also submitting herewith a Second Information Disclosure Statement, citing one Japanese Patent. A first Information Disclosure Statement was filed with the CIP on April 30, 2001. Applicants respectfully request that the Examiner consider the art in both Information Disclosure Statements.

Consideration and an early allowance are respectfully solicited.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE SPECIFICATION

The paragraph starting at page 2, line 3 has been amended as follows.

The present invention relates to an optical apparatus having a function of correcting image [shakes] <u>shaking</u> caused by changes [of] <u>in the</u> relative angles of an object to be photographed and the optical apparatus.

The paragraph starting at page 2, line 9 has been amended as follows.

Optical apparatuses of the kind arranged to be capable of correcting image [shakes] <u>shaking</u> have heretofore been developed in varied manners. Fig. 7 shows an example of such optical apparatuses. In the case of the optical apparatus shown in Fig. 7, the so-called variable angle prism 100 is arranged in front of an optical system composed of lens units 101 to 104 and a diaphragm 105 to correct [the] image [shakes] <u>shaking</u> before a light flux P from an object comes to be incident on the optical system. Referring to Fig. 7, the lens units 101 to 104 and the diaphragm 105 are supported by a fixed tube 105. An image sensor 107 is arranged to convert into an electrical signal an optical image formed on a focal plane [which] <u>that</u> is located in rear of the fixed tube 106.

The paragraph starting at page 3, line 2 has been amended as follows.

In view of the above problem, some [of] known optical apparatuses have been developed to permit reduction in size. For example, an optical apparatus is arranged to have the variable angle prism disposed between two lens units within an optical system composed of a plurality of lens units. Another optical apparatus, which is of the type called a lens shift type, is arranged to correct [the] image [shakes] shaking by moving some of a plurality of lens units in a direction perpendicular to an optical axis. Some other optical apparatus [has] have been developed to have an electronic image-shake correcting function called an electronic image stabilizing device, which corrects image [shakes] shaking in the following manner. A CCD, which has a larger area than an actually necessary area as an image sensor (thus requiring use of a large optical system having an image circle covering the whole surface of the CCD), is arranged to correct image [shakes] shaking by varying the reading position thereof according to information on detected image [shakes detected] shaking.

The paragraph starting at page 4, line 10 has been amended as follows.

In the case of the above-stated function of optically correcting [image-shakes] image shaking by deflecting a light flux within the optical system, if the optical apparatus is arranged to correct the image [shakes] shaking in such a way as to have an object image not moving on the image forming plane at the time of a change of relative angles of the object and the optical apparatus, the vignetting degree of the light flux at each point of an object image on the image forming plane would vary to change the light quantity distribution of the object image, as the relative angles of the object and the optical apparatus have changed.

The paragraph starting at page 4, line 22 has been amended as follows.

Such a state is explained with reference to Fig. 9. In Fig. 9, image forming positions are shown on the abscissa axis and the luminance of the image is shown on the ordinate axis. A one-dot-chain line shown in Fig. 9 represents the initial distribution of light quantity obtained before the relative angles of the object and the optical apparatus change. Full lines "a" and "b" shown in Fig. 9 represent light quantity distributions obtained with image [shakes] shaking corrected when the relative angles change, for example, alternately to the right and to the left. When image [shakes which] shaking that actually [take] takes place continuously are corrected in this manner, although the object image is corrected to be not moving on an image plane, the [image shake] image-shake correction results in variations of luminance of the picture taking place in synchronism with the image [shakes] shaking. The luminance variations become salient particularly in the peripheral part of the image plane. As a result, the quality of an image thus obtained degrades to an unacceptable degree.

The paragraph starting at page 5, line 13 has been amended as follows.

Further, the electronic [image shake] image-shake correcting function also has a problem similar to that of the optical [image shake] image-shake correcting function. In this case, the light quantity distribution on the [image forming] image-forming plane does not change, since the relation between the [image forming] image-forming plane 116 and the optical system, which is composed of the lens units 111 to 114 and the diaphragm 115 as shown in Fig. 8, is

unchanging. However, when the object image is caused to move by the change [of] <u>in</u> relative angles of the object and the optical apparatus, the reading position also changes following the movement of the object image, for example, as indicated by reading positions I and II in Fig. 10. The change of the reading position then brings about the same phenomenon as in the case of the optical [image shake] <u>image-shake</u> correcting function.

The paragraph starting at page 6, line 2 has been amended as follows.

The invention is directed to the solution of the <u>problems with</u> prior art described above. It is, therefore, an object of the invention to provide an optical apparatus arranged to be capable of giving an easily viewable image of high quality by alleviating luminance variations [which] <u>that</u> occur in the peripheral parts of an image plane in correcting image [shakes] <u>shaking</u> and by lessening a luminance difference between central and peripheral parts of the image plane, particularly at a part in the neighborhood of a telephoto end position where the variations of luminance become conspicuous.

The paragraph starting at page 6, line 16 has been amended as follows.

(1) The full-open aperture diameter of a diaphragm provided for control over the quantity of a light flux passing through a variable magnification optical system having an [image shake] <u>image-shake</u> correcting function is limited according to the focal length.

The paragraph starting at page 6, line 21 has been amended as follows.

(2) An on-axial light flux in the neighborhood of the telephoto end position of the variable magnification optical system, which takes therein an off-axial light flux as well, and the on-axial light flux is limited by a diaphragm.

The paragraph starting at page 6, line 26 has been amended as follows.

(3) The on-axial light flux is limited by an auxiliary diaphragm [which] that is disposed close to a main diaphragm arranged to determine an F-number.

The paragraph starting at page 7, line 1 has been amended as follows.

(4) The amount of shift of a lens unit to be shifted in a direction perpendicular to an optical axis is corrected according to information on the position of the [variable magnification] variable-magnification optical system in such a way as to cancel a movement of an image caused by a tilt of the [variable magnification] variable-magnification optical system by the shift of the lens unit.

The paragraph starting at page 7, line 14 has been amended as follows.

Fig. 1 shows a state obtained at a telephoto end position of a [variable magnification]

variable-magnification optical system of an optical apparatus according to a first embodiment of the invention.

The paragraph starting at page 7, line 18 has been amended as follows.

Fig. 2 shows a state obtained at a wide-angle end position of the [variable magnification] variable-magnification optical system of the optical apparatus according to the first embodiment of the invention.

The paragraph starting at page 8, line 1 has been amended as follows.

Fig. 5 schematically shows the arrangement of an optical apparatus having an [image shake] image-shake correcting function according to the invention.

The paragraph starting at page 8, line 8 has been amended as follows.

Fig. 7 is a longitudinal sectional view of the conventional optical apparatus having an [image shake] image-shake correcting function.

The paragraph starting at page 8, line 22 has been amended as follows.

Fig. 12 is an exploded perspective view showing a [zoom lens] zoom-lens barrel shown

in Fig. 11.

The paragraph starting at page 8, line 24 has been amended as follows.

Fig. 13 is an exploded perspective view of an [image shake] image-shake correcting unit mounted on the zoom lens shown in Fig. 11.

The paragraph starting at page 9, line 11 has been amended as follows.

Fig. 18 is a block diagram showing a system for [image shake] image-shake correction control and diaphragm control arranged in the second embodiment.

The paragraph starting at page 9, line 24 has been amended as follows.

Figs. 1 and 2 show a variable magnification optical system having an [image shake] image-shake correcting function according to a first embodiment of the invention. The [variable magnification] variable-magnification optical system is composed of lens units 1 to 4 having positive, negative, positive and positive refracting powers, respectively. In Fig. 1, the [variable magnification] variable-magnification optical system is shown [as] in a state obtained with the optical system at a telephoto end position. Fig. 2 shows the [variable magnification] variable-magnification optical system [as] in a state obtained with the optical system at a wide-angle end position. The lens unit 1 is a fixed lens unit. The lens unit 2 is a variator lens

unit, which is provided for varying the magnification of the optical system by moving backward and forward. The lens unit 3 is an image-shake correcting lens unit [which] that is arranged to deflect a light flux by moving (shifting) in a direction perpendicular to an optical axis. The lens unit 4 is a focusing lens unit provided for adjusting the focus of the [variable magnification] variable-magnification optical system by moving backward and forward. A diaphragm 5 is provided for limiting the quantity of a light flux passing through the optical system. A focal plane 6 is arranged to form thereon an image of a photo-taking object.

The paragraph starting at page 11, line 6 has been amended as follows.

In Fig. 3, the image forming positions are shown on the abscissa axis and the luminance of the image is shown on the ordinate axis. A full line "c" represents a light quantity distribution obtained on the focal plane 6 shown in Fig. 1. A two-dot-chain line "d" represents a light quantity distribution obtained when the diaphragm 5 is opened to a position where it does not block the on-axial light flux "a". A broken line "e" represents a light quantity distribution obtained when the diameter of the lens unit 1 is reduced to a size at which only such a portion of the on-axial light flux that can pass through the full-open aperture of the diaphragm as shown in Fig. 1 is allowed to pass. In other words, with the lens unit 1 arranged to have a large diameter to receive the on- and off-axial light fluxes in large quantity, at least the on-axial light flux is made to be limited by the diaphragm 5. This arrangement is made such that a difference in luminance between the central and peripheral parts of the image plane is lessened. Fig. 4 shows variations of [light quantity] light-quantity distribution taking place with the [image shake] image-shake

correction actually performed. Lines or curves c', c", d' and d" show the variations of [light quantity] light-quantity distribution obtained with the diaphragm 5 at its positions where the lines "c" and "d" are obtained, respectively. Fig. 4 clearly shows that the variations taking place in the peripheral part of the image plane, in particular, is greatly improved by limiting the full-open aperture diameter of the diaphragm 5, as indicated by variations I and II of luminance.

The paragraph starting at page 12, line 7 has been amended as follows.

Fig. 5 shows in outline the arrangement of the optical apparatus having the [image shake] image-shake correcting function. For the lens units 1 to 4, the diaphragm 5 and the focal plane 6 shown in Fig. 1, the following parts are provided as shown in Fig. 5. A fixed tube 7 is arranged to hold the lens unit 1. A moving frame 8 is arranged to hold the lens unit 2 in a known bar-sleeve structure to be movable in the direction of the optical axis by a stepping motor through a known mechanism including a rack and a feed screw.

The paragraph starting at page 12, line 17 has been amended as follows.

A shift frame 9 is arranged to hold the lens unit 3 and to be movable in a direction perpendicular to the optical axis O by a guide mechanism (not shown), which is arranged between a holding frame 10 and the shift frame 9. The position of the shift frame 9 is arranged to be determined in the directions of pitch and yaw by a driving means and a position detecting means which are not shown.

The paragraph starting at page 12, line 25 has been amended as follows.

A moving frame 11 is arranged to hold the lens unit 4 in a known bar-sleeve structure to be movable in the direction of the optical axis by a stepping motor through a known mechanism including a rack and a feed screw. A known diaphragm device 12 is arranged to support and drive the diaphragm 5. The diaphragm device 12 is preferably a so-called iris diaphragm [which] <u>that</u> has a plurality of sickle-shaped diaphragm blades arranged in a circumferential direction so as to form an approximately circular aperture by rotating the plurality of diaphragm blades at the same time.

The paragraph starting at page 13, line 14 has been amended as follows.

A microcomputer 16 is arranged to control [lens driving] <u>lens-driving</u> actions. When a power supply is switched on, the microcomputer 16 causes a focus [motor driving] <u>motor-driving</u> circuit 19 and a zoom [motor driving] <u>motor-driving</u> circuit 20 to rotate their respective stepping motors for moving the moving frames 11 and 8 while continuously monitoring the output of a [focus reset] <u>focus-reset</u> circuit 17 and that of a [zoom reset] <u>zoom-reset</u> circuit 18. The output of the [focus reset] <u>focus-reset</u> circuit 17 and that of the [zoom reset] <u>zoom-reset</u> circuit 18 are inverted respectively when each of the moving frames 11 and 8 comes to a predetermined position, where light from a light emitting part of a photo-interrupter disposed at a fixed part is blocked, or allowed to pass at a boundary part, by a light blocking part of each moving frame. After that, with this position used as a datum position, the number of driving steps of each

stepping motor is counted within the microcomputer 16 to find the absolute position of each of the lens units 4 and 2. Information on the focal length can be accurately obtained by this arrangement. A [diaphragm driving] diaphragm-driving circuit 21 is provided for opening and closing the diaphragm 5 under the control of the microcomputer 16. The aperture of the diaphragm 5 is controlled on the basis of information B on luminance of the video signal taken in the microcomputer 16. Information on the diaphragm aperture thus obtained is detected by an aperture value detecting circuit 22 and is supplied to the microcomputer 16.

The paragraph starting at page 14, line 13 has been amended as follows.

By the aperture control operation, the full-open (maximum) aperture diameter of the diaphragm is limited according to the focal length to have some area where the diaphragm is not opened as indicated by a hatched part of Fig. 6, which shows the focal length on the abscissa axis and the full-aperture diameter of the diaphragm on the ordinate axis. Under this aperture control, [a] the difference in luminance between the central part and the peripheral part of the image plane can be kept small, particularly by cutting off the on-axial light flux on the side of the telephoto end position.

The paragraph starting at page 14, line 24 has been amended as follows.

Although the structure of an optical system is generally arranged to have a smaller luminance difference between the central part and the peripheral part of an image plane in the

telephoto end than in the wide-angle end, an image formed on [a] an image forming plane is caused by one and the same image shake to move to a greater extent in proportion to the focal length in the telephoto end than in the wide-angle end. Therefore, the problem of luminance variations on the image plane caused by actual image [shakes] shaking becomes more serious at the telephoto end than at the wide-angle end. This calls for some improvement in [light quantity] light-quantity distribution obtained in the neighborhood of the telephoto end of the lens system.

The paragraph starting at page 15, line 9 has been amended as follows.

The optical apparatus is provided with a [pitch angle] pitch-angle (vertical slanting angle) detecting circuit 23 and a [yaw angle] yaw-angle (horizontal slanting angle) detecting circuit 24. Each of these angles is detected by integrating the output of an angular velocity sensor which, for example, is a vibration gyro or the like secured to the optical apparatus. The outputs of the two [angle detecting] angle-detecting circuits 23 and 24, which show information on slanting angles of the optical apparatus, are supplied to the microcomputer 16.

The paragraph starting at page 15, line 19 has been amended as follows.

For moving the lens unit 3 in correcting image [shakes] shaking, the optical apparatus is provided with pitch (vertical) and yaw (horizontal) [coil driving] coil-driving circuits 25 and 26. Each of the pitch [coil driving] coil-driving circuit 25 and the yaw [coil driving] coil-driving circuit 26 is arranged to generate a driving force for the lens unit 3 by the so-called moving coil

device in which a coil is disposed at a gap of a magnetic circuit having a magnet.

The paragraph starting at page 15, line 27 has been amended as follows.

A pitch (vertical) [position detecting] position-detecting circuit 27 and a yaw (horizontal) [position detecting] position-detecting circuit 28 are provided for detecting amounts of shift of the lens unit 3 with respect to the optical axis. Each of the circuits 27 and 28 is arranged, for example, to have a [light emitting] light-emitting element and a [light receiving] light-receiving element fixedly opposed to each other, to have a slit which is formed in the shift frame 9 interposed in between these light emitting and receiving elements, and to obtain a shift amount of the lens unit 3 as an electrical signal. The information on the amount of shift thus obtained is also supplied to the microcomputer 16.

The paragraph starting at page 16, line 13 has been amended as follows.

When the lens unit 3 moves in a direction perpendicular to the optical axis, a light flux passing there is bent. As a result, the position of an object image formed on the CCD 13 moves. The microcomputer 16 then controls and causes the optical system to move [to] the same amount as the movement amount of the image position actually caused by the slant of the optical apparatus in a direction opposite to the direction in which the object image moves. The [image shake] image-shake correcting action [is] thus can be carried on to keep the formed image unshakable even when the optical apparatus slants to shake the image.

The paragraph starting at page 16, line 25 has been amended as follows.

Within the microcomputer 16, shift-amount signals obtained from the pitch [position detecting] position-detecting circuit 27 and the yaw [position detecting] position-detecting circuit 28 indicating the shift amounts of the lens unit 3 are respectively subtracted from inclination signal obtained from the [pitch angle] pitch-angle detecting circuit 23 and the [yaw angle] yaw-angle detecting circuit 24 indicating the inclinations of the optical apparatus to obtain difference signals. Then, the pitch [coil driving] coil-driving circuit 25 and the yaw [coil driving] coil-driving circuit 26 are caused to drive the shift frame 9 according to the difference signals. Under this control, the lens unit 3 is driven to make the difference signals smaller, so that the image can be kept at an objective position.

The paragraph starting at page 17, line 11 has been amended as follows.

In the case of the first embodiment, the lens unit 3, which is arranged to be shifted in a direction perpendicular to the optical axis, is disposed closer to an image pickup surface than the variator lens unit 2. The moving amount of the image in relation to the amount of shift of the lens unit 3 comes to vary according to the position of the variator lens unit 2, i.e., according to the focal length. The amount of shift of the lens unit 3 is, therefore, decided not merely according to the optical-apparatus inclination signals obtained from the pitch angle detecting circuit 23 and the yaw angle detecting circuit 24 but is corrected also according to information on the position of the variator lens unit 2. The movement of the image due to the slant of the optical

apparatus is thus arranged to be canceled by shifting the lens unit 3 in this manner.

The paragraph starting at page 17, line 27 has been amended as follows.

In the first embodiment, the aperture position of the diaphragm, which is arranged to vary the quantity of a light flux passing through the optical system, is controlled electrically to limit the full-open aperture diameter of the diaphragm according to the focal length. More specifically, the full-open aperture diameter of the diaphragm is controlled to decrease accordingly as the position of the lens system shifts from the wide-angle end position to the telephoto end position. In a case where no [image shake] image-shake correcting action is required, therefore, the optical system is usable in a brighter full-open state at its telephoto end position by removing the limitation on the full-open aperture diameter of the diaphragm. It is also possible to change the arrangement to have some auxiliary diaphragm arranged near to a main (F-number determining) diaphragm to mechanically impose the above-stated limitation on the full-open aperture diameter in a [sate] state of being interlocked with the movement of the variator lens unit 2, as will be described later herein.

The paragraph starting at page 18, line 19 has been amended as follows.

The first embodiment described above makes the [image shake] image-shake correction by shifting, in a direction perpendicular to the optical axis, the third lens unit of the [variable

magnification] variable-magnification optical system composed of four lens units, which are arranged to have refractive powers in the order of positive, negative, positive and positive refractive powers. However, the type of the optical system and the lens unit to be shifted are not limited to those of the first embodiment described above. The invention is applicable also to an optical image shake correcting arrangement having a [variable angle] variable-angle prism within a [variable magnification] variable-magnification optical system and also to an electronic [image shake] image-shake correcting arrangement for [the] so-called electronic image stabilization. More specifically, the invention is applicable also to an apparatus arranged to attain an [image shake correcting] image-shake-correcting effect by processing an electrical signal obtained from an image sensor, which is arranged on the image forming plane to convert an optical image into an electrical signal.

The paragraph starting at page 19, line 11 has been amended as follows.

In the first embodiment described above, a [variable magnification] variable-magnification optical system having the [image shake] image-shake correcting function is arranged to limit, according to the focal length, the full-open aperture diameter of a diaphragm, which is provided for controlling the amount of a light flux passing through the optical system. By this, a difference in luminance between the central and peripheral parts of an image plane can be lessened particularly in the neighborhood of a telephoto end position of the optical system where the difference becomes salient. Therefore, an optical apparatus can be arranged to be capable of [giving] producing high quality images according to the arrangement of the invention.

The paragraph starting at page 19, line 26 has been amended as follows.

Fig. 11 is a sectional view showing essential parts of a zoom lens (barrel) for a video camera to which the invention is applied as the second embodiment. Fig. 12 is an exploded perspective view showing in part the [zoom lens] zoom-lens barrel shown in Fig. 11.

The paragraph starting at page 20, line 3 has been amended as follows.

Referring to Figs. 11 and 12, a fixed tube 201 is arranged to hold a first lens unit L1. A rear tube 202 is arranged to hold a low-pass filter 203. A CCD image sensor, which is not shown, is mounted in rear of the low-pass filter 203. An [image shake] image-shake correcting unit 204 is arranged to hold a third lens unit L3, which is arranged as a correction lens to be driven in a direction perpendicular to an optical axis. The [image shake] image-shake correcting unit 204 is interposed in between the fixed tube 1 and the rear tube 2 and is fixed in position with screws. A second lens tube 205 is arranged to hold a second lens unit L2, which is provided for zooming. Two guide bars 206a and 206b are arranged to be supported respectively at their front and rear parts by the fixed tube 201 and the rear tube 202 and to have the second lens tube 205 movable in the direction of the optical axis. A fourth lens tube 207 is arranged to hold a fourth lens unit L4, which is provided for focus adjustment. As in the second lens tube 205, the fourth lens tube 207 is supported also by the guide bars 206a and 206b to be movable in the direction of the optical axis. The two guide bars 206a and 206b are arranged along the optical axis and on opposite sides of the optical axis not only to guide the second and fourth lens tubes 205 and 207,

but also to prevent the second and fourth lens tubes 205 and 207 from turning around the optical axis.

The paragraph starting at page 21, line 2 has been amended as follows.

An IG meter (IG meter unit) 208 is arranged to drive, by means of an electromagnetic actuator, diaphragm blades 803 and 804 which jointly constitute a first diaphragm means, as shown in Fig. 14. The IG meter 208 is carried jointly by the fixed tube 201 and the [image shake] image-shake correcting unit 204 in a state of being interposed in between them. ND filters 806 and 807 are mounted on the front side of the diaphragm blade 803 and on the rear side of the diaphragm blade 804, respectively. The aperture diameter of the first diaphragm means is arranged to be variable according to the quantity of light incident on the CCD (sensor). Diaphragm blades 820 constitute a second diaphragm means. The second diaphragm means is composed of, in the case of the second embodiment, six diaphragm blades 820. The diameter of an aperture defined by the diaphragm blades 820 is arranged to be variable according to the zooming position of the zoom lens, in such a manner that the quantity of on-axial light and that of off-axial light, obtained when the [image shake] image-shake correcting unit 204 is driven to decenter the third lens unit L3, are balanced with each other by restricting the on-axial light flux obtained with the optical system on its telephoto side. Incidentally, the first diaphragm means is arranged to substantially determine an F-number of the zoom lens.

The paragraph starting at page 21, line 27 has been amended as follows.

A zoom motor 209 has its driving part and its output screw part held in one body by means of a U-shaped metal plate. The zoom motor 209 is secured to the fixed tube 201 with screws. A rack 210 is mounted on the second lens tube 205. The second lens tube 205 is arranged to be driven in the direction of the optical axis with the rack 210 in <u>a</u> mesh <u>state</u> with the screw part of the zoom motor 209. In this case, any intermeshing play and any back-lash in the direction of thrust are removed by a spring 211<u>,</u> which is arranged to urge the rack 210 in the direction of intermeshing and in the direction of the optical axis.

The paragraph starting at page 23, line 11 has been amended as follows.

A photo-interrupter 215 is secured to the fixed tube 201 with a screw after it is soldered to a circuit board 216. The photo-interrupter 215 is arranged to detect the datum position of the second lens tube 205 with a [light blocking] <u>light-blocking</u> wall part 205b<u>,</u> which is formed integrally with the second lens tube 205 passing through an interval between the light projecting part and the light receiving part and to allow the zoom motor 209 to move the second lens tube 205 to each zooming position according to the number of pulses inputted to the zoom motor 209. Focus adjustment is also likewise arranged to be made by detecting a [light blocking] <u>light-blocking</u> wall part 207b of the fourth lens tube 207 as a datum position with a photo-interrupter 217 and a circuit board 218<u>,</u> which are mounted on the rear tube 202 and by driving the focus motor 212 stepwise as necessary.

The paragraph starting at page 23, line 27 has been amended as follows.

The [image shake] image-shake correcting unit 204 is arranged as follows.

The paragraph starting at page 24, line 1 has been amended as follows.

Fig. 13 is an exploded perspective view of the [image shake] image-shake correcting unit 204 in the second embodiment. In Fig. 13, reference numeral 240 denotes a fixed frame. The fixed frame 240 is provided with two bosses 240a (see Fig. 12) for positioning the fixed frame 240 with respect to the fixed tube 201 and two bosses 240b for positioning the fixed frame 240 with respect to the rear tube 202. The [image shake] image-shake correcting unit 204 is thus carried jointly by the fixed tube 201 and the rear tube 202. A moving frame 241 is arranged to hold the third lens unit L3, which is an [image shake] image-shake correction lens.

The paragraph starting at page 24, line 20 has been amended as follows.

The pins 242 and the slots 240c corresponding to them are evenly spaced at intervals of 120° within one and the same plane and are arranged in a balanced state to have no moment around the optical axis caused to act on the moving frame 241 by a load brought about by any sliding friction. A roll preventing plate 244 is arranged to prevent the moving frame 241 from turning around the optical axis in correcting image [shakes] shaking. The roll preventing plate 244 is provided with slots 244a and 244b, which are fitted on a boss 240e provided on the fixed frame 240 and a boss, which is not shown. Other slots 244c and 244d provided also in the roll preventing plate 144 are fitted on bosses (not shown), which are provided on the moving frame

241. Hole parts 244e and 244f, which are provided in the roll preventing plate 244, [for allowing] allow support posts 240f and 240g formed integrally with the fixed frame 240 to pierce through these hole parts. The arrangement is such that, even if the roll preventing plate 244 moves to its maximum extent, the support posts 240f and 240g do not interfere with the roll preventing plate 244. In other words, the roll preventing plate 244 is arranged to move only in the vertical direction as viewed in Fig. 13 with respect to the fixed frame 240 while the moving frame 241 is arranged to be movable only horizontally as viewed in Fig. 13 with respect to the roll preventing plate 244. The combination of these moving directions enables the moving frame 241 to move vertically and horizontally as viewed in Fig. 13 without turning or rolling around the optical axis with respect to the fixed frame 240.

The paragraph starting at page 25, line 24 has been amended as follows.

Coils 245a and 245b, which are secured to the moving frame 241, are provided for driving the moving frame 241 in the horizontal direction (hereinafter referred to as the X direction) and in the vertical direction (hereinafter referred to as the Y direction). Magnets 246a and 246b are respectively magnetized to have two poles in the X and Y directions. The magnets 246a and 246b are secured to the fixed frame 240 and fixed in position with lower yokes 247a and 247b, which are made of iron or the like arranged to attract them from behind the fixed frame 240 to cause them to be inserted respectively through hole parts 240h and 240i of the fixed frame 240. An upper yoke 248, which is made of the same material as the lower yokes 247a and 247b, is secured with screws 253 to the support posts 240f and 240g of the fixed frame 240 from its

front side together with a sensor holder 249, which will be described later. The upper yoke 248 is thus arranged to form a magnetic circuit for driving in the X and Y directions. More specifically, a magnetic circuit is formed for driving in the X direction jointly by the magnet 246a, the lower yoke 247a and the upper yoke 248 with the coil 245a inserted in the magnetic circuit. Another magnetic circuit is formed for driving in the Y direction jointly by the magnet 246b, the lower yoke 247b and the upper yoke 248 with the coil 245b inserted therein. An electromagnetic actuator of the moving coil type is formed in this manner.

The paragraph starting at page 26, line 23 has been amended as follows.

Light projecting elements 250a and 250b are IREDs or the like. Light receiving elements 251a and 251b are PSDs or the like. These elements are inserted into the sensor holder 249 from its peripheral side and are fixed in position by bonding. Narrow slits 241c and 241d, which are formed integrally with the moving frame 241, are inserted in between each of the pairs of the light-projecting and light-receiving elements. Of infrared light rays projected from the light projecting elements 251a and 251b, only the infrared rays passing through the slits 241c and 241d are received by the light receiving elements 251a and 251b. The positions of the moving frame 241 in the X and Y directions are detected by using the infrared rays thus received. The light projecting elements 250a and 250b and the light receiving elements 251a and 251b are connected to a flexible printed circuit board 252 (shown in a divided state in Fig. 13) and are thus connected to a control circuit provided on the side of a camera body, which is not shown. The wiring of the coils 245a and 245b is connected to a driving circuit, which is also disposed on the

side of the camera body.

The paragraph starting at page 27, line 19 has been amended as follows.

Fig. 14 is a plan view of the IG meter unit 208. The IG meter unit 208 includes the diaphragm blades 803 and 804, which constitute the first diaphragm means. The diaphragm blades 803 and 804 are held by a fixed frame 801 to be movable in parallel with each other in the vertical direction as viewed in Fig. 14, in a state of being guided by the bosses 801a and 801b, which are formed integrally with the fixed frame 801. Bosses 805a and 805b are provided on an arm 805 [which] <u>that</u> is arranged integrally with the rotating shaft of a meter 800. The bosses 805a and 805b engage slots 803a and 804a [which] <u>that</u> are provided respectively in the diaphragm blades 803 and 804. ND filters 806 and 807 are attached to the diaphragm blades 803 and 804 by bonding. The ND filters 806 and 807 are thus arranged to reduce a light quantity to prevent the aperture diameter from becoming a predetermined aperture diameter because the quality of images deteriorates due to an adverse effect of diffraction if the aperture diameter becomes too small. To prevent the ND filters 806 and 807 from coming into sliding contact with the diaphragm blades 803 and 804, the ND filters 806 and 807 are disposed respectively in front of the diaphragm blade 803, which is located on the front side of the optical axis and in rear of the diaphragm blade 804.

The paragraph starting at page 28, line 16 has been amended as follows.

When the diaphragm blades 803 and 804 are fully opened, the ND filters 806 and 807 are in a state of being located at an optical path. The ND filters 806 and 807 come to completely cover the optical path when the aperture reaches a predetermined [aperture value] aperture-value position. When the aperture is further stopped down, the aperture is completely covered by the diaphragm blades 803 and 804. Further, the two upper and lower ND filters 806 and 807 are arranged to simultaneously enter the optical path to make the variation of the peripheral light quantity on the image plane uniform in correcting image [shakes] shaking.

The paragraph starting at page 28, line 27 has been amended as follows.

Fig. 15 shows the arrangement of the second diaphragm means in the second embodiment. In Fig. 15, reference numeral 820 denotes six blades. Each of the blades 820 is swingably carried by the fixed frame 801 with its hole part 820a engaging a boss 801c provided on the fixed frame 801. Each of the blades 820 is provided with a slot 820b [which] that engages one of bosses 821a provided on a ring 821, which is arranged to be rotatable around the optical axis. The ring 821 has a slot 821b formed in a part extending from its periphery. The slot 821b of the ring 821 engages a boss 823a of an arm 823, which is fixedly attached to the rotating shaft of a second diaphragm driving meter 822. Therefore, the rotation torque of the meter 822 is transmitted through the arm 823 to the ring 821 to cause the ring 821 to rotate. The rotation of the ring 821 causes the six blades 820 to swing on the holes 820a in such a way as to vary the aperture diameter.

The paragraph starting at page 29, line 17 has been amended as follows.

The second diaphragm means is thus arranged to vary the diameter of an aperture according to the zooming position of the lens system irrespective of the quantity of light. In correcting image [shakes] shaking, the second diaphragm means serves to alleviate variations taking place in the peripheral light quantity on the image plane. In the case of the image-shake correction by the shift method, the correction lens is disposed inside the optical system. Therefore, a peripheral light flux is determined by an optical system disposed in front of the correction lens. The quantity of peripheral light then varies when the light flux is bent by the correction lens at the time of [image shake] image-shake correction. In most [of] zoom lenses, a light flux is restricted on the side of a telephoto end by the effective diameter of a front lens. Therefore, [a] the difference in light quantity between a central part and a peripheral part of an image plane increases on the side of the telephoto end. In view of this, the second embodiment is arranged to appositely restrict the peripheral light flux by lessening the aperture diameter of the diaphragm accordingly as the position of the optical system shifts from its wide-angle side toward its telephoto end in such a way as to alleviate a change of the peripheral light quantity even when the correction lens is shifted.

The paragraph starting at page 30, line 14 has been amended as follows.

Figs. 16 and 17 are graphs showing the peripheral light quantity obtained by shifting the correction lens at the telephoto end. In each of these graphs, positions from the center of the

image plane are shown in the horizontal direction and the quantities of light are shown in the vertical direction. Fig. 16 shows the peripheral light quantity obtained without using the second diaphragm means. Fig. 17 shows the peripheral light quantity obtained with the second diaphragm means used. In each of Figs. 16 and 17, a broken line shows a state of having the correction lens at the center of the optical axis, and a full line shows a state of having the correction lens shifted. The state of the full line and the state of the broken line are considered to appear one after another while the [image shake] image-shake correction is in process. Therefore, luminance differences indicated with a reference symbol A appear one after another in the peripheral part of the image plane to give a disagreeable impression to the eye. As shown in Figs. 16 and 17, although the absolute light quantity becomes less in the case of Fig. 17 with the second diaphragm means used than in the case of Fig. 16, the change A of the peripheral light quantity, which takes place at the time of [image shake] image-shake correction, can be lessened by the use of the second diaphragm means in the case of Fig. 17.

The paragraph starting at page 31, line 11 has been amended as follows.

To avoid having the peripheral light quantity unnaturally vary at the time of [image shake] image-shake correction, the aperture is preferably arranged to be in a shape as close to a circle as possible. Further, in Fig. 14, a two-dot-chain line 808 represents an aperture shape of the second diaphragm means obtained in the telephoto end. The aperture is shaped in such a way as to be not affected by the ND filters 806 and 807 in the telephoto end even in a case where the diameter of the aperture 808 of the second diaphragm means is variable.

The paragraph starting at page 31, line 21 has been amended as follows.

Control over the [image shake] <u>image-shake</u> correcting unit 204 and the diaphragm unit 208 is next described as follows.

The paragraph starting at page 32, line 1 has been amended as follows.

The microcomputer 70 computes the amount of vibration of the camera on the basis of a detection signal obtained from the vibration sensor 71 and computes a target (or objective) position of the correction lens L3 at which [an] image [shake] <u>shaking,</u> resulting from the vibration of the camera, can be canceled. Then, according to the result of computation of the amount of movement, the coils 245a and 245b of the electromagnetic actuator are energized to drive the correction lens L3. In driving the correction lens L3, the position of the correction lens L3 is detected by [correction lens] <u>correction-lens</u> position sensors 50 and 51. The result of such detection is fed back to the microcomputer 70, so that the correction lens L3 can be accurately driven and moved to the target position computed.

The paragraph starting at page 32, line 16 has been amended as follows.

In the zoom lens, the amount of movement (the target position) of the correction lens L3 for canceling [an] image [shake] <u>shaking</u> varies according to the focal length. In view of this, the number of pulses, with which the second lens unit L2 is driven, is counted to detect the focal

length by a zoom position sensor 72. Then, the amount of driving of the correction lens L3 is adjusted according to the focal length detected.

The paragraph starting at page 33, line 6 has been amended as follows.

The second embodiment is arranged, as described above, to appositely restrict an on-axial light flux on the telephoto side (not restricting it on the wide-angle side) by the second diaphragm means according to the zoom position. Although the absolute quantity of light is decreased thereby, the variations taking place in the peripheral light quantity at the time of [image shake] image-shake correction is effectively lessened by this arrangement, so that image [shakes] shaking can be corrected without causing images to give any disagreeable impression.

The paragraph starting at page 34, line 2 has been amended as follows.

Fig. 19 shows in a plan view the second diaphragm means in the third embodiment. In Fig. 19, reference numeral 820 indicates six blades [which] that are arranged in the same manner as in the second embodiment. Hole parts 820a of the blades 820 engage the bosses 851c provided on the fixed frame 851, so that the blades 820 are swingably carried. The blades 820 are provided with slots 820b [which] that engage the bosses 852a provided on the ring 852, which is arranged to be rotatable around the optical axis.

The paragraph starting at page 34, line 12 has been amended as follows.

As in the second embodiment, the third embodiment is also arranged to be capable of varying the aperture diameter by the rotation of the ring 821. In this case, however, the aperture diameter is arranged to be varied in association with the movement of the second lens tube 501, which is provided for zooming, instead of using the electromagnetic actuator.

The paragraph starting at page 34, line 18 has been amended as follows.

In Fig. 19, only the sleeve part 501a of the second lens tube 501 is illustrated. The sleeve part 501a is provided with an end face cam 501b. The ring 852 has an arm part 852b extending from its periphery. The arm part 852 has an end face 852c. The rotating position of the ring 852 is restricted with the end face 852c arranged to abut on the end face cam 501b of the sleeve part 501a of the second lens tube 501. A tension coil spring 853 is attached at its one end to a hook 852d, which protrudes from the arm part 852b. The other end of the spring 853 is attached to a projection 851d provided on the fixed frame 851. The coil spring 853 is thus arranged to constantly urge the end face 852c of the ring 852 to be pushed against the end face cam 501b of the sleeve part 501a.

The paragraph starting at page 35, line 14 has been amended as follows.

Since the arrangement of the third embodiment obviates the necessity of using an actuator for driving the blades, unlike in the case of the second embodiment, the third embodiment can be more simply arranged and also contributes to a reduction in [electric energy] electric-energy

consumption.

The paragraph starting at page 35, line 19 has been amended as follows.

While the third embodiment uses a [moving coil] moving-coil type actuator for driving the correction lens, the same advantageous effect can be attained by replacing this actuator with a motor or an electrostrictive element or some other electromagnetic actuator.

The paragraph starting at page 35, line 24 has been amended as follows.

Further, to have an aperture shape close to a circle and laterally and vertically symmetrical, the first diaphragm of the diaphragm unit is arranged to have two parallel moving blades and two ND filters attached thereto. The second diaphragm of the diaphragm unit is arranged, also for the same purpose, to have six blades. However, according to the invention, the diaphragm unit is not limited to the arrangement disclosed. For example, both the first and second diaphragms may be arranged to be composed of six blades or to be using two [swinging type] swinging-type blades.

The paragraph starting at page 36, line 7 has been amended as follows.

The arrangement of the third embodiment obviates the necessity of using an actuator for driving the second diaphragm means, so that deterioration of images at the time of [image shake]

image-shake correction can be minimized with simple structural arrangement.

The paragraph starting at page 36, line 12 has been amended as follows.

According to the arrangement of each of the second and third embodiments, a lens barrel or an optical apparatus using the lens barrel can be arranged to be suited for a high magnification zoom lens [which] that never deteriorates its optical performance for an entire image plane even while [image shake] image-shake correction is in process.

The paragraph starting at page 36, line 18 has been amended as follows.

A particularly advantageous feature of each of the second and third embodiments lies in the provision of the second diaphragm means, which is arranged, in addition to an ordinary diaphragm (the first diaphragm means), to give a predetermined aperture diameter according to the zooming position of the optical system. In accordance with the invention, the second diaphragm means may be arranged to be driven by a meter by detecting a zooming position from the driving pulses of the lens barrel or to be driven according to the movement of a variator lens tube in a mechanically interlocked state. By such an arrangement, the peripheral light flux can be appositely limited according to zooming, so that the luminance variations taking place in the peripheral part of an image plane at the time of [image shake] image-shake correction can be lessened over the whole range of zooming.